Electrostatics and Circuits:

Variable		Unit
	P	W
	V	V
	ΔU_e	J
	I	A
	R	Ω
(constant)	k	$N \cdot m^2/C^2$
	q or Q	C
	r	m
	d	m
	$\overline{F}$	N
electric field	$\overline{E}$	N/C
energy	E	J

Find all V's and I's:

$R_1 = 70\,\Omega$

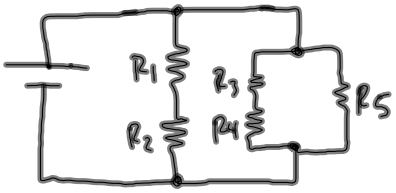
$R_2 = 90\,\Omega$

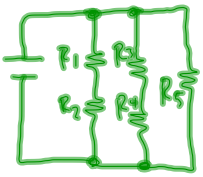
$100\,V$

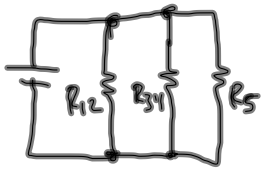
$R_3 = 110\,\Omega$

$R_4 = 85\,\Omega$

$R_5 = 92\,\Omega$







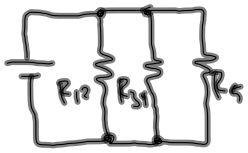
$R_{12} = 160\,\Omega$

$R_{34} = 195\,\Omega$

$$\frac{1}{R_{eq}} = \frac{1}{R_{12}} + \frac{1}{R_{34}} + \frac{1}{R_5}$$

$R_{eq} = 44.9\,\Omega$

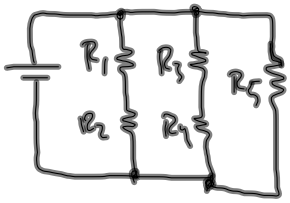
$$I_{total} = \frac{V_{total}}{R_{eq}} = \frac{100\,V}{44.9\,\Omega} = 2.22\,A$$



$$I_{12} = \frac{V_{total}}{R_{12}} = 0.625\,A$$

$$I_{34} = \frac{V_{total}}{R_{34}} = 0.513\,A$$

$$I_5 = \frac{V_{total}}{R_5} = 1.09\,A$$

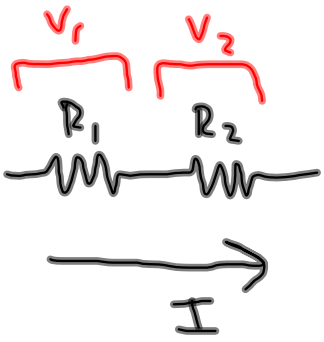


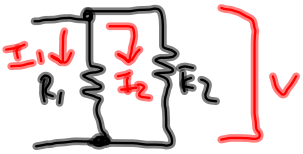
$V_1 = I_{12} R_1 = 44.7\,V$

$V_2 = I_{12} R_2 = 56.3\,V$

$V_3 = I_{34} R_3 = 56.4\,V$

$V_4 = I_{34} R_4 = 43.6\,V$





Series Connections:

Same I

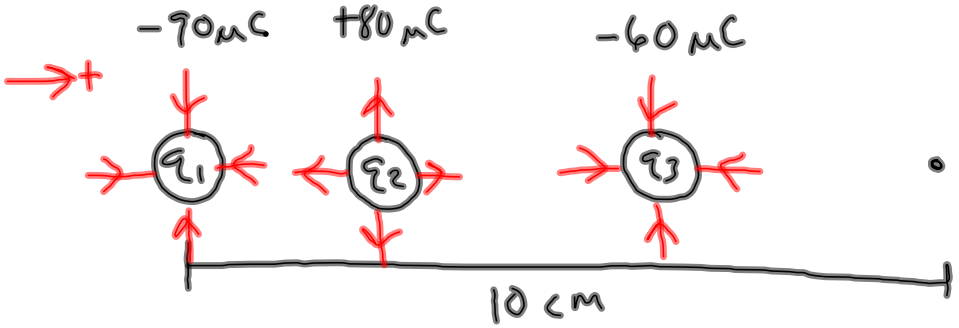
Different V's

Parallel Connections:

Same V

Different I's

Three charges are arranged in a line. Charge 1 has a value of -90 microC and is located at the origin, charge 2 has a value of +80 microC and is located at x = 2 cm, and charge 3 has a value of -60 microC and is located at x = 5 cm.
a) Find the value of the electric field at the point x = 10 cm.
b) If a charge of +50 microC is placed at this point, what is the electric force that the charge experiences?



$r_1 = 0.1\text{ m} \quad r_2 = 0.08\text{ m} \quad r_3 = 0.05\text{ m}$

a) $\bar{E}_{net} = \bar{E}_1 + \bar{E}_2 + \bar{E}_3$

$= k\left[\frac{-q_1}{r_1^2} + \frac{q_2}{r_2^2} + \frac{-q_3}{r_3^2}\right]$

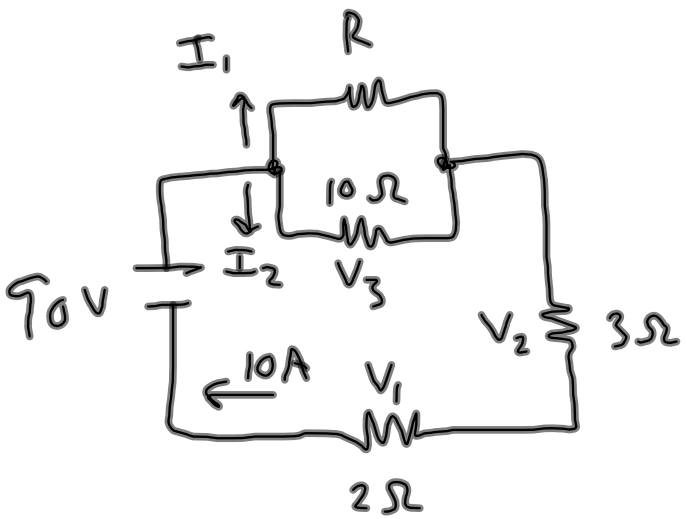
$= (8.99E9\ N\cdot m^2/C^2)\left[\frac{-(90E-6C)}{(0.1m)^2} + \frac{(80E-6C)}{(.08m)^2} - \frac{(60E-6C)}{(.05m)^2}\right]$

$= -1.84E8\ N/C$

b) $\bar{E} = \frac{\bar{F}}{q}$

$\bar{F} = q\bar{E} = (+50E-6C)(1.84E8\ N/C)$

$= -9215\ N$



$R = 6.67\,\Omega$

$V_3 = 40\ V$

$V_2 = 30\ V$

$V_1 = 20\ V$

$I_1 = 6\ A$

$I_2 = 4\ A$

$I_{total} = 10\ A$

$I_2 = \frac{V_3}{10\,\Omega} = 4A$

$V_1 = I_{total}(2\,\Omega) = 20\ V$

$I_{total} = I_1 + I_2$

$V_2 = I_{total}(3\,\Omega) = 30\ V$

$I_1 = 10A - 4A = 6A$

$V_{total} = V_1 + V_2 + V_3 \Rightarrow V_3 = 90\ V - 20\ V - 30\ V$

$= 40\ V$

$R = \frac{V_3}{I_1} = \frac{40\ V}{6\ A} = 6.67\,\Omega$